# A NEW SPECIES OF *BABYCURUS* (SCORPIONES: BUTHIDAE) FROM NORTHERN OMAN[1]

**Graeme Lowe**[2]

ABSTRACT. A new species of *Babycurus* is described from Jabal Akhdar, in the Al Hajar Mountains of Northern Oman. The discovery extends the range of this Afrotropical genus to southeastern Arabia. It represents a significant disjunction with the only other known record of *Babycurus* on the Arabian peninsula, that of *B. zambonellii* from southwestern Yemen and Eritrea.

*Babycurus* Karsch, 1886, currently includes fourteen named species and two named subspecies, mostly distributed over tropical and subtropical Africa (Lamoral & Reynders 1975; Sissom, 1990). The genus has not been reviewed since Vachon (1940) provided a key to the known species. Recently, Sissom (1994) reported *Babycurus zambonellii* Borelli, 1902, from San'a, Yemen, providing the first record of this genus in the Arabian peninsula. The present paper describes a new *Babycurus* recently discovered in the course of a detailed survey of the scorpion fauna of the Sultanate of Oman. The new find is regarded as the sister species of *B.zambonellii*, and extends the range of the genus to the Oriental region.

## *Babycurus exquisitus,* NEW SPECIES

(Figs. 1-9)

**Diagnosis.** *Babycurus exquisitus* from Oman is closely related to *Babycurus zambonellii* Borelli, 1902, from Eritrea. Both are differentiated from other *Babycurus* by the following characters: relatively small species (adults < 50 mm); pale straw-colored body; metasoma uniformly wide, segment V smooth to weakly granular with all keels obsolete; vesicle of telson smooth, covered with a dense brush of long setae on its ventral and lateral surfaces (mostly broken off in the holotype of *B. zambonellii*); ventral surface of pedipalp femur with scattered coarse granules at base, otherwise smooth; external keel of pedipalp femur strong, denticulate to granulate; dorsointernal, dorsomedian and dorsoexternal keels of pedipalp patella well developed, smooth to granulose; manus of pedipalp chela smooth, keels reduced or obsolete; dentate margin of fixed finger with 7-8 linear, non-imbricated subrows of primary denticles; subrows of pedipalp fingers flanked by a single external accessory denticle; pedipalps and legs without dense pubescence.

*Babycurus exquisitus* is further differentiated as follows: small size, body length less than 40 mm; longer pectines: pectine length/carapace length 0.78-

[1] Received October 14, 1999, Accepted November 26, 1999.

[2] 75-16 Drexelbrook Dr, Drexel Hill, Pennsylvania 19026, USA. e-mail: lowe@monell.org

1.0; keels of metasoma I-IV finely denticulate or crenulate; telson elongate, streamlined, vesicle length/depth 1.8-2.0, pectine length/vesicle depth 2.6-3.1; pedipalp chela of male with long thin fingers and a swollen manus, that of female very slender with a narrow manus; chela length/width 4.2-4.7 (males), 6.12 (female), manus length/width 1.57-1.76 (males), 1.86 (female), movable finger length/underhand length 1.45-1.74 (males), 2.35 (female).

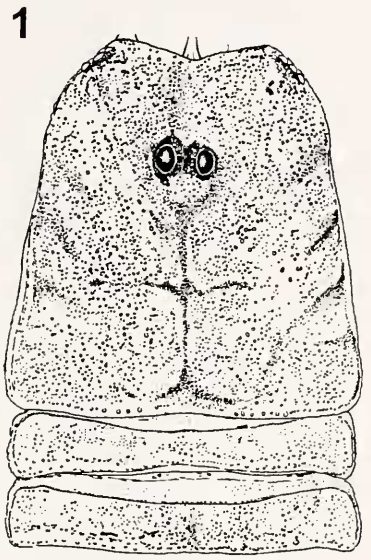
*Babycurus zambonellii* differs as follows: larger size, up 50 mm in length; pectine length/carapace length 0.69-0.70; keels of metasoma ranging from denticulate or crenulate to heavily granulose; telson more bulbous, vesicle length/depth 1.6-1.8, pectine length/vesicle depth 2.0-2.1; subaculear spine more stout; chela of female less slender, chela length/width 5.14, manus length/width 1.77, movable finger length/underhand length 1.87.

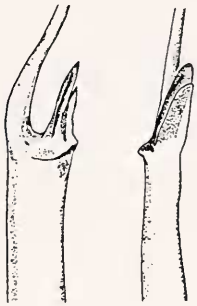
**Description of holotype male (adult):** Coloration: Base color uniform pale yellow; chela fingers, metasoma V and telson light orange; cheliceral teeth, denticles of chela fingers, articular condyles of chela movable finger and leg segments, aculeus and subaculear spine dark reddish brown; black pigmentation around median and lateral eyes.

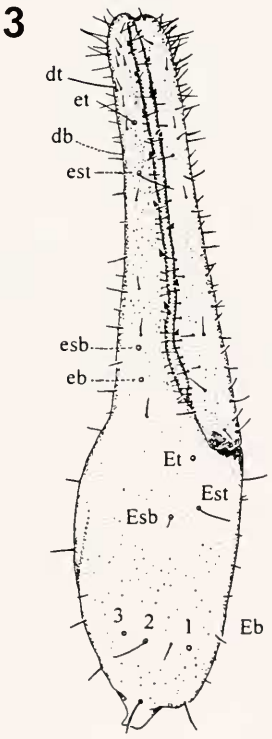
Prosoma: Carapace subrectangular, nearly parallel-sided (Fig. 1); anterior margin concave, bearing a single median pair of setae; entire surface coarsely granular except for posterior and lateral furrows, and small smooth patches behind the lateral eyes; superciliary crests granulose, all other keels reduced or absent; posterior median furrow deep, posterior lateral furrows moderate; ocular tubercle not elevated; three lateral eyes present; distance of center of ocular tubercle from anterior margin 0.28 times length of carapace. Chelicerae with typical buthid dentition; two denticles on ventral surface of fixed finger, as in other *Babycurus* (Sissom, 1990).

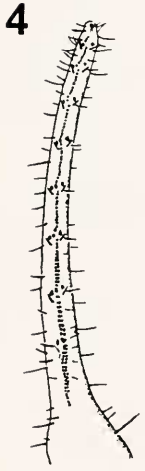
Mesosoma: Tergite I without keels, tergites II-VI with a single granulate median keel; median keel weak on tergite II, moderate on III, strong on IV-VI; tergite VII pentacarinate, with a broad, convex granular median keel and two pairs of well developed crenulate lateral keels; all tergites with dense granulation on intercarinal surfaces and a row of separated granules along posterior margin; sternite III with convex medial area slightly wrinkled, bearing 11 reddish setae; sternites IV-VI smooth, with lateral margins lightly shagreened; sternite VII shagreened, with a pair of smooth, nearly obsolete median keels, and obsolete lateral keels indicated by fine granules; tips of pectines extending to proximal third of trochanter IV; pectinal tooth count, left 22, right 21; combs with nine smooth middle lamellae bearing few setae; basal middle lamella with rounded corners, proximal corner not produced into a lobe or projection; basal piece with transverse suture, anterior area convex on sides with a deep anterior median furrow lined with short macrosetae, posterior area flat, steeply sloped, border convex with a median lobe.

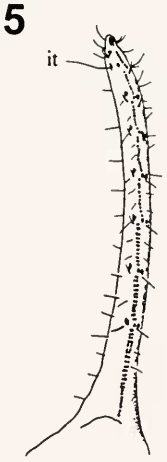
Metasoma (Fig. 9) (nomenclature of Levy & Amitai, 1980): Segment I with 10 keels, intermediary keels complete; segments II-IV with 8 keels, intermediary keels absent; all keels obsolete on segment V; dorsal and dorsolateral keels moderately developed and finely crenulate to serrate on segments I-III, weak and feebly granulate on IV; intermediary keels on I moderate, crenulate; ventrolateral keels weak and finely granulate on I-III, nearly obsolete on IV; ventral keels weak and nearly smooth on I-III, essentially obsolete on IV; dorsal and lateral intercarinal surfaces on segments I-III finely shagreened, more densely so on anterior seg-



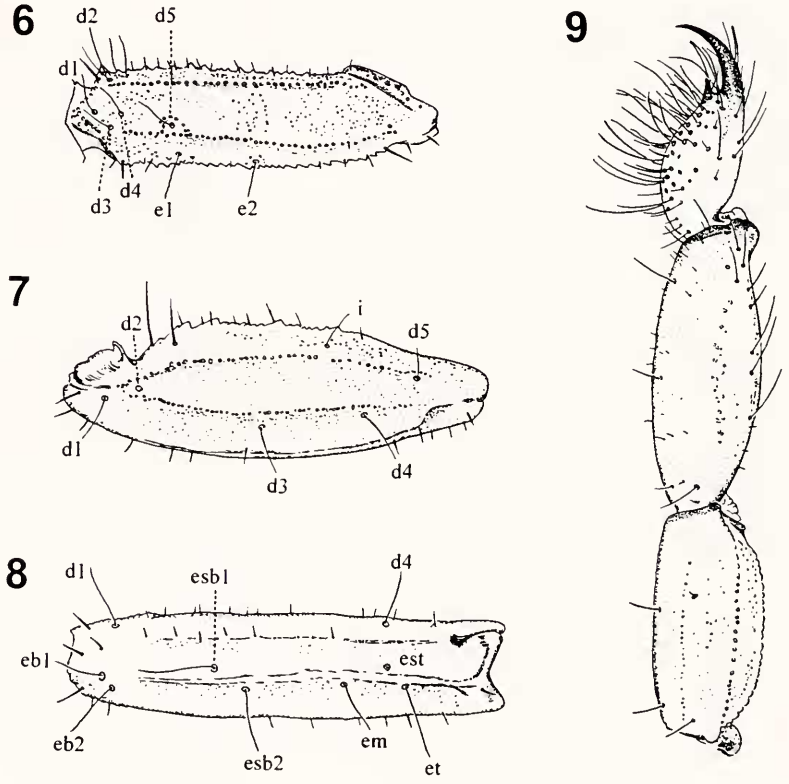




Figures 1-5. *Babycurus exquisitus* n.sp., male. 1, Carapace and tergites I-II. 2, Right hemispermatophore, lobes at base of flagellum, dorsal (left) and ental (right) aspects. 3, Right pedipalp chela, external aspect. 4, Left chela, movable finger dentition. 5, Left chela, fixed finger dentition. Figs. 1, 3-5: holotype male. Fig. 2: paratype male.

ments; other intercarinal surfaces smooth; dorsal surface with shallow median furrow on I-IV, convex on V; chaetotaxy: segments I-IV with 3 pairs of macrosetae (including posterior marginal setae) on ventral keels, 2 pairs of macrosetae on ventrolateral keels; metasoma V with 5-7 long, backwardly curved macrosetae along dorsolateral margins, and 2-3 curved macrosetae on posterior lateral flank; anal margin smooth, bearing over a dozen large and small setae.

Telson: (Fig. 9) Telson smooth, slender, teardrop-shaped, with a prominent subaculear spine; ventral, lateral and posterior dorsal surfaces of vesicle clothed in a brush of numerous (approximately 140) long, curved macrosetae; dorsal surface also bearing scattered short, fine microsetae; aculeus shorter than vesicle, rather stout and strongly curved.

Pedipalp: Femur (Fig. 6) 3.86 times longer than wide, tetracarinate, with external, dorsoexternal, dorsointernal, and ventrointernal keels distinct, crenulate to serrate (Fig. 6); intercarinal surfaces smooth to shagreened; dorsal surface shagreened, dorsoexternal surface




Figures 6-9. *Babycurus exquisitus* n.sp., holotype male. 6, Right pedipalp femur, dorsal aspect. 7, Right pedipalp patella, dorsal aspect. 8, Right pedipalp patella, external aspect. 9, Metasoma IV, V and telson, lateral aspect.

nearly smooth except for scattered proximal granules, ventral surface nearly smooth on distal half, with scattered granulation on proximal half; internal surface coarsely shagreened, divided by a broad ridge with coarse polished granules; patella (Figs. 7, 8) 3.18 times longer than wide, with five weak keels; dorsointernal and dorsomedian keels finely granular, dorsoexternal keel nearly smooth, external keel smooth, ventroexternal keel polished and weakly granulose; internal surface divided by a granulate ridge; dorsointernal surface sparsely granular, other surfaces smooth; pedipalp chela (Fig. 3) smooth with digital and dorsal marginal keels weak, smooth, confined to distal manus and fixed finger; other keels obsolete; manus swollen, manus width/underhand length 0.58; chela fingers slender, proximally scalloped; movable finger length/underhand length 1.45; dentition (Figs. 4, 5): fixed finger with 8 subrows of primary denticles; movable finger with 8 subrows of primary denticles, including long compound proximal subrow on basal lobe; proximal three subrows of fixed finger and proximal two on movable finger composed of bicuspid denticles; enlarged primary denticle on subrows 1-6 of both fingers flanked by enlarged internal and external accessory denticles; proximal subrow of movable finger compound, with single enlarged internal accessory denticle near midpoint; tip of movable finger with two enlarged internal subdistal denticles flanked by an external row of four small denticles; tip of fixed finger with one enlarged internal subdistal denticle; trichobothrial pattern orthobothriotaxic, type A-β (Vachon, 1974, 1975) (Figs. 3, 6-8); femur with trichobothrium $d_2$ displaced internally; chela with *et* located near distal end of denticle subrow 4 of fixed finger, *est* at middle of subrow 5.

Legs: Basitarsi with two ventral rows of long macrosetae and numerous smaller setae on prolateral and retrolateral surfaces; telotarsi with two ventral rows of short macrosetae, and sparse setation on prolateral and retrolateral surfaces; prolateral tarsal spurs with a small basal bifurcation bearing a single stout seta, retrolateral tarsal spurs simple; ungues stout.

Measurements of holotype male (mm) (L, length; W, width; D, depth): total length 33.50; carapace, L 3.75, ocular tubercle to anterior margin 1.08; metasoma I, L 2.50, W 2.00; metasoma II, L 3.00, W, 1.83; metasoma III, L 3.17, W 1.75; metasoma IV, L 3.67, W 1.75; metasoma V, L 4.17, W, 1.69; telson vesicle, W 1.08, D 1.17; pedipalp chela, L 6.54; underhand, L 2.67; manus, W 1.54, D 1.67; fixed finger, L 3.75, movable finger L 3.88; pedipalp femur, L 3.71, W 0.96; pedipalp patella L 4.29, W 1.35; pectine, L 3.63.

Hemispermatophore from paratype male (Fig. 2): two long, laminiform, apically blunt lobes at base of flagellum; inner lobe separate from flagellum, slightly widened at base; outer lobe opposing inner lobe; basal lobe rudimentary, forming a lamina on a low, transverse ridge.

**Paratype female (adult):** differs from holotype male as follows: body larger, carapace and tergites proportionately wider; tergites flatter, less convex laterally; pedipalp patella more slender, 3.42 times longer than wide; pedipalp chela more slender, manus width/underhand length 0.53; fingers much longer, movable finger length/underhand length 2.35; proximal scalloping absent; denticles in proximal subrows not bicuspid; fixed finger with 7 subrows of primary denticles, with compound proximal subrow formed by fusion of two subrows (fusion point marked by internal and external accessory denticles); movable finger with 8 subrows of primary denticles, including long, proximal subrow flanked by a single external accessory denticle; pectines shorter, only attaining distal tip of coxa IV; basal piece of pectines wider; metasoma IV with ventral and ventrolateral keels weak but distinct, smooth to weakly crenulated; metasoma V with ventrolateral keels weak, marked by fine granules; ventromedian keel indicated by weak, polished granulations; pectinal tooth counts and metasomal morphometrics similar in the two sexes.

Measurements of paratype female (mm): total length 39.00; carapace, L 4.42, ocular tubercle to anterior margin 1.25; metasoma I, L 2.67, W 2.21; metasoma II, L 3.25, W 1.96; metasoma III, L 3.42, W 1.83; metasoma IV, L 3.92, W 1.79; metasoma V, L 4.58, W 1.75; telson vesicle, W 1.29, D 1.33; pedipalp chela, L 7.40; underhand, L 2.25; manus, W 1.21, D 1.25, fixed finger, L 4.92, movable finger, L 5.29; pedipalp femur, L 4.17, W 1.17; pedipalp patella, L 4.92, W 1.44; pectine, L 3.46; pectinal tooth counts, left 22, right 22.

**Variation**. Adult males exhibit little variation in color, size or form: body length 33-34 mm, carapace length 3.65-3.75 mm; morphometric ratios: carapace width/length 0.91-0.94, pedipalp femur length/carapace length 0.98-1.01, pedipalp femur length/width 3.67-3.86, pedipalp patella length/width 3.02-3.18, pedipalp movable finger length/underhand length 1.45-1.74; pedipalp chela length/width 4.25-4.66, metasomal segment length/width: I 1.16-1.25, II 1.55-1.64, III 1.64-1.82, IV 1.99-2.10, V 2.47-2.49. Male pectinal tooth counts: 21-22 (2 combs with 21 teeth, 4 with 22); pedipalp denticle subrows (including proximal): movable finger 8-9 (3 fingers with 8 subrows; 3 with 9), fixed finger 8.

A single immature male differs from adults as follows: pedipalp: patella slightly more slender, chela more elongate, manus not swollen, fingers lacking proximal scalloping and bicuspid dentition; metasoma IV and V with fully developed carination, not convex and smooth; metasoma IV with ventral and ventrolateral keels moderate, smooth to weakly crenulate; metasoma V with ventromedian, ventrolateral and dorsolateral keels weak to moderate, smooth to weakly crenulate.

**Holotype.** Adult male, Oman, Jabal Shams, Jabal Akhdar, Al Hajar Al Gharbi, 23°14.29'N 57°11.62'E, 1855 m, ultraviolet detection on ground surface in gravelly wadi with trees and rocks, surrounded by boulder strewn slopes, 2 October 1994, G.Lowe, M.D.Gallagher; depository: Naturhistorisches Museum, Basel, Switzerland.

**Paratypes:** 1 adult female, 1 immature, same locality as holotype (NMB); 1 adult male, Oman, Jabal Shams, Jabal Akhdar, Al Hajar Al Gharbi, ultraviolet detection, in narrow rocky wadi, walking slowly on rock, 23°14.27'N 57°11.68'E, 1870 m, 2 October 1994, G.Lowe, M.D.Gallagher (GL); 1 adult male, Oman, Jabal Shams, in spider web in tree, 23°14.31'N 57°11.64'E, 1900 m, 14 October 1993, 21:12 hrs, G.Lowe, M.D.Gallagher (NMB).

**Comparative material:** *Babycurus zambonellii*: holotype (male?), Ethiopia (Eritrea), Chenafena, Magretti (MRSN); 1 female, Yemen, Sana'a, June-July 1981, Lanza, Borri & Poggesi, (MZUF).

**Depositories**: GL, collection of G.Lowe; NMB, Naturhistorisches Museum, Basel, Switzerland; MZUF, Museo Zoologico "La Specola" dell'Università de Firenze, Florence, Italy; MRSN, Museo Regionale di Scienze Naturali, Turin, Italy.

**Etymology.** The specific epithet derives from the Latin adjective, *exquisitus*, meaning careful or delicate, in reference to the behavior and morphology of the animal.

**Remarks:** The holotype of *Babycurus zambonellii* from Eritrea was assumed to be a male (Borelli, 1902; Sissom, 1994). If so, it would be atypical in that it lacks certain male traits observed in some other members of genus: scalloping and bicuspid dentition at the base of the pedipalp fingers, and a

heavy, swollen manus. The manus resembles that of females of other African members of the genus. It is as robust as the manus of male *B. exquisitus*, but the latter species has more slender chelae than other *Babycurus*. Sissom (1994) referred a female from Sana'a, Yemen, to *B. zambonellii*. The form of the pedipalp and telson of this specimen are intermediate between the holotype of *B. zambonellii* and the paratype female *B. exquisitus*, but the metasoma is more elongate than either. Immature buthids can have a more slender pedipalp and metasoma; however, the size of the Sana'a female indicates it to be a subadult or adult. Study of additional material is needed to clarify variation and sexual dimorphism in *B. zambonellii*.

The *Babycurus* in Eritrea, Sana'a and northern Oman comprise a series of allopatric populations likely to be related by common descent. All possess a dense brush of long setae on the telson, a unique synapomorphy within the genus. The decision to place the Jabal Akhdar population in a separate species is based on clear differences in the shape of the telson and pedipalp chelae, smaller body size, more delicate form, and the distance and isolation from its nearest relatives in southwest Arabia and Ethiopia.

*Babycurus* is primarily an Afrotropical taxon adapted to mesic and humid environments. One may speculate that it invaded Arabia during the Miocene or earlier, crossing a land bridge at the south end of the Red Sea (Coleman, 1993), and spreading to northern Oman under mesic conditions. Subsequent development of hot, arid conditions in Arabia and north Africa during the Quaternary period restricted its distribution to higher elevations. Post-Miocene uplift of the Al Hajar ranges (Lippard et al, 1986) provided a refuge for the northern populations. I propose that *B. exquisitus* represents a Pleistocene relict confined to the highest parts of the Al Hajar mountains. It has not been found in extensive collections made at lower elevations in the Al Hajar mountains and Batinah coastal region of northern Oman, and it is unknown from the hot, arid steppes and dune systems of central Oman.

ACKNOWLEDGMENTS

The author is grateful to: HH The Minister of National Heritage and Culture, Sultanate of Oman, for sponsoring the scorpion study; Michael D. Gallagher for his strong support and guidance, including participation in trips to Jabal Akhdar to collect the types of this new species; the staff of the Ministry of National Heritage and Culture who provided support for my 1993-94 visits to Jabal Akhdar, including Said Ali Said Al-Farsi, and Saddiqa Rhamdan; Andrew S. Gardner, Jim Dundon, Ian Harrison, J.Neil Barnes and many other collectors in Oman; the curators who loaned *Babycurus* material: L.Bartolozzi and Sarah Whitman (MZUF), N. Franzese and Lisa Levi (MRSN), H.W. Levi and Laura Leibensperger (Museum of Comparative Zoology, Harvard University) and Scott F.Larcher (National Museum of Natural History, Washington DC); and František Kovařík and Michael E. Soleglad for critical review of the manuscript, helpful comments and discussion.

## LITERATURE CITED

**Borelli, A.** 1902. Di una nuova specie di scorpione della Colonia Eritrea. Boll. Mus. Zool. Anat. comp. R. Univ. Torino. 17 (422): 1-3.

**Coleman, R.G.** 1993. Geologic evolution of the Red Sea. Oxford Monogr. Geol. Geophys. No. 24, New York, Oxford Univ. Press.

**Lamoral, B.H. & Reynders, S.C.** 1975. A catalogue of the scorpions described from the Ethiopian faunal region up to December 1973. Ann. Natal Mus. 22 (2): 489-576.

**Levy, G. & Amitai, P.** 1980. Fauna Palaestina. Arachnida I. Scorpiones. Jerusalem: The Israel Acad. Sciences and Humanities.

**Lippard, S.J., Shelton, A.W. & Gass, I.G.** 1986. The ophiolite of northern Oman. Mem. Geol. Soc. London. No. 11. Oxford, Blackwell.

**Sissom, W. D.** 1990. Systematics, biogeography and paleontology. In: G. A. Polis (ed.), Biology of Scorpions, pp. 64-160. Stanford Univ. Press, Stanford, CA.

**Sissom, W.D.** 1994. Descriptions of new and poorly known scorpions of Yemen (Scorpiones: Buthidae, Diplocentridae, Scorpionidae). Fauna Saudi Arabia. 14: 3-39.

**Vachon, M.** 1940. Voyage en A.O.F. de L. Berland et J. Millot - Scorpions. V. Bull. Soc. Zool. Fr. 65: 170-184, figs. 1-25.

**Vachon, M.** 1974. Étude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). Bull. Mus. Nat. d'Hist. Nat. Paris, (3), 140 (Zool. 104), 1973: 857-958.

**Vachon, M.** 1975. Sur l'utilisation de la trichobothriotaxie du bras des pédipalpes des Scorpions (Arachnides) dans le classement des genres de famille des Buthidae Simon. C.R. Hebd. Séances Acad. Sci., D. 281 (21): 1597-1599.